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INT CL[5] B63B

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(54) Floating structures

(57) A collapsible, air-filled hull comprises a flexible skin k, the top f of which is rigid or non-rigid; and which may be expanded or collapsed for transport or storage, by means of collapsible and / or removable supports g situated at the interior of the hull and operated from the exterior of the hull, air being sucked into the hull during the operation of expansion and escaping from the hull during the operation of collapsing, through closable vents i incorporated in the hull, or top f. The said collapsible hull is suitable for using on its own or for incorporating into different types of floating structures such as rafts, catamarans, or pontoons.

FIG. 3

See fig. 19

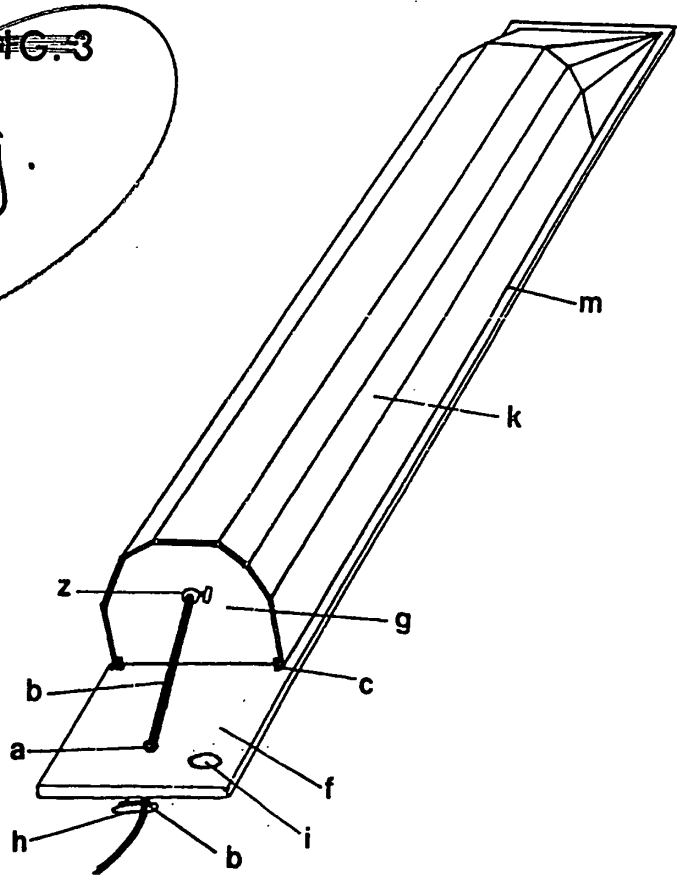

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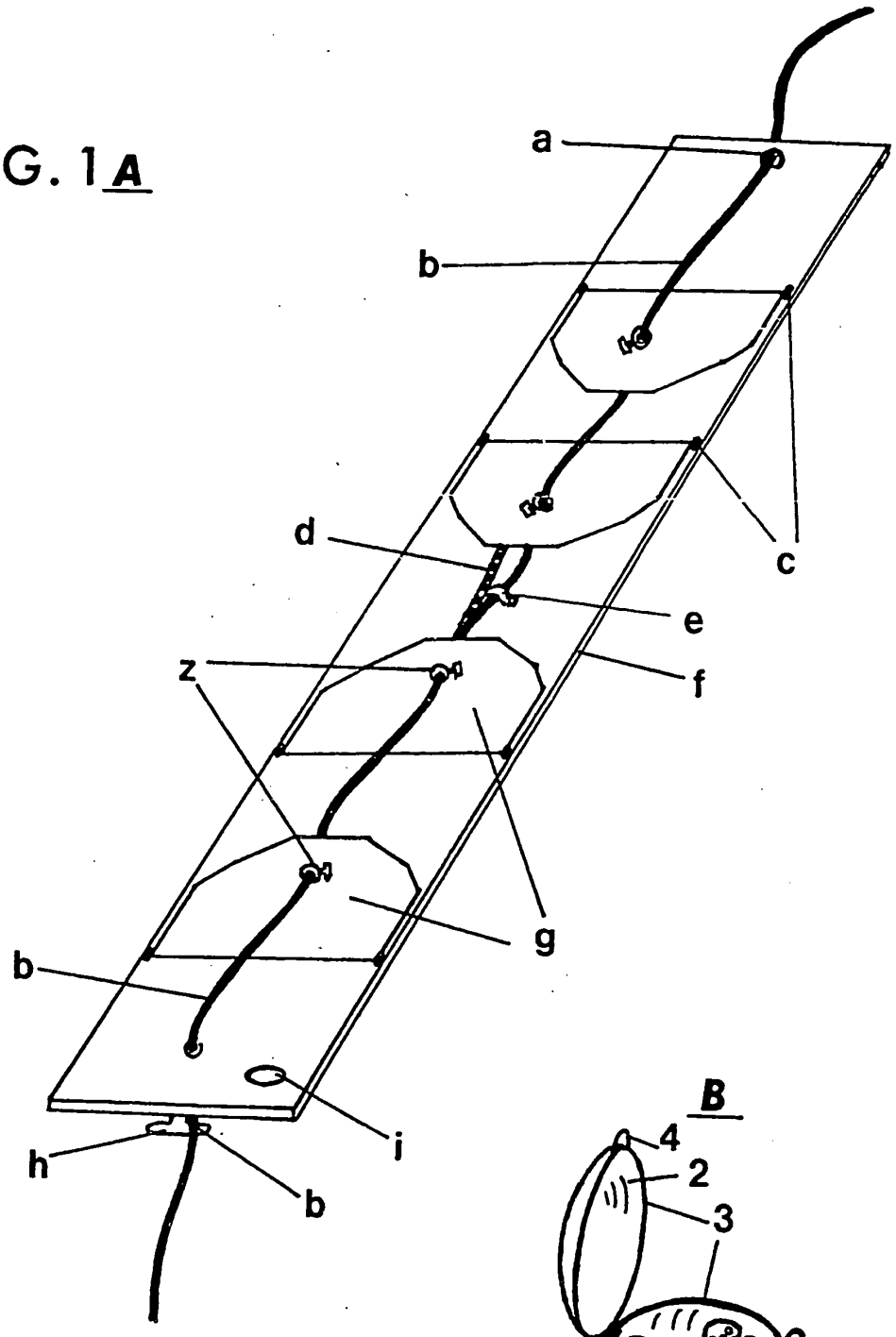
FIG. 1 A



B

FIG. 2

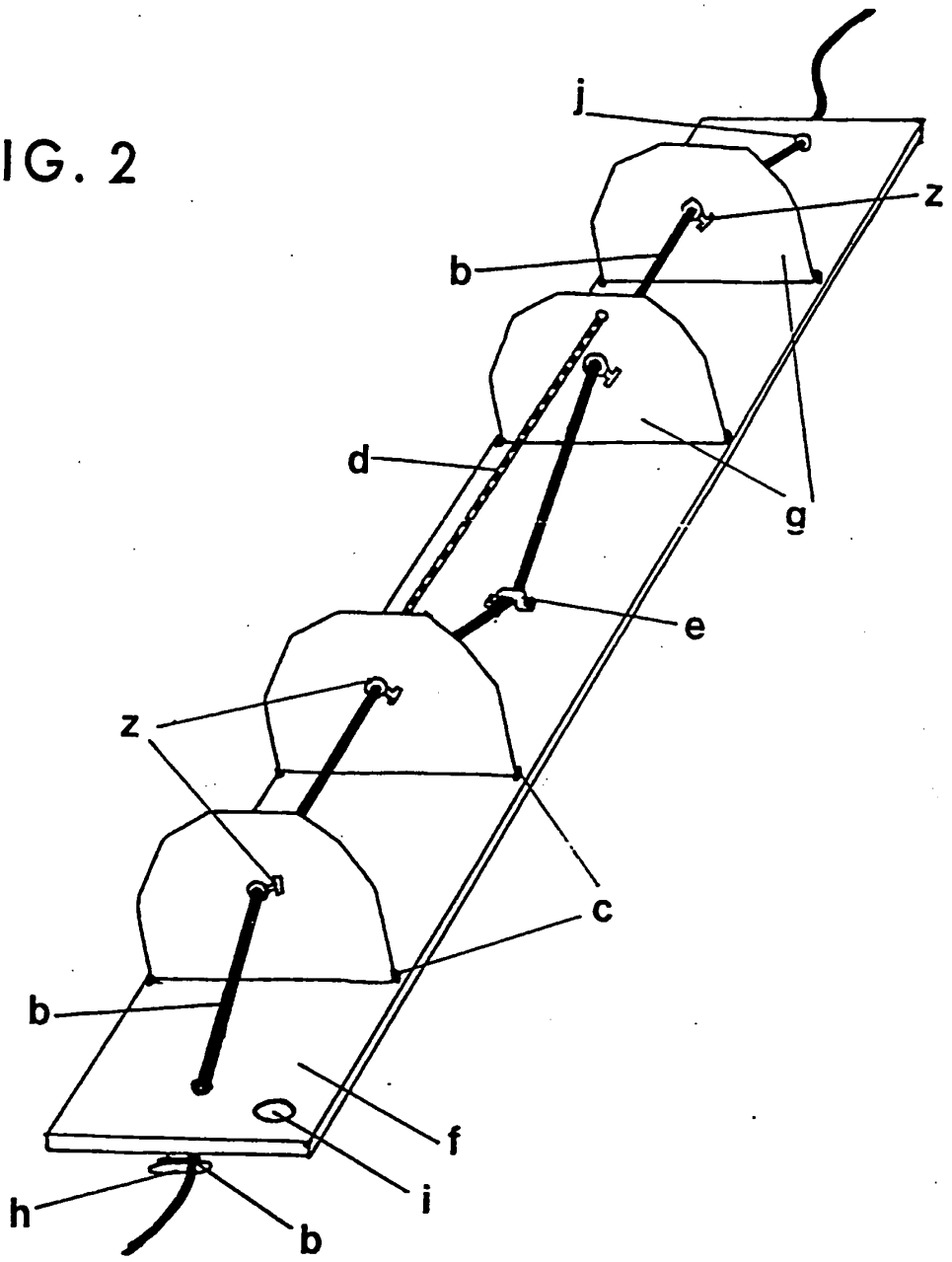


FIG. 3

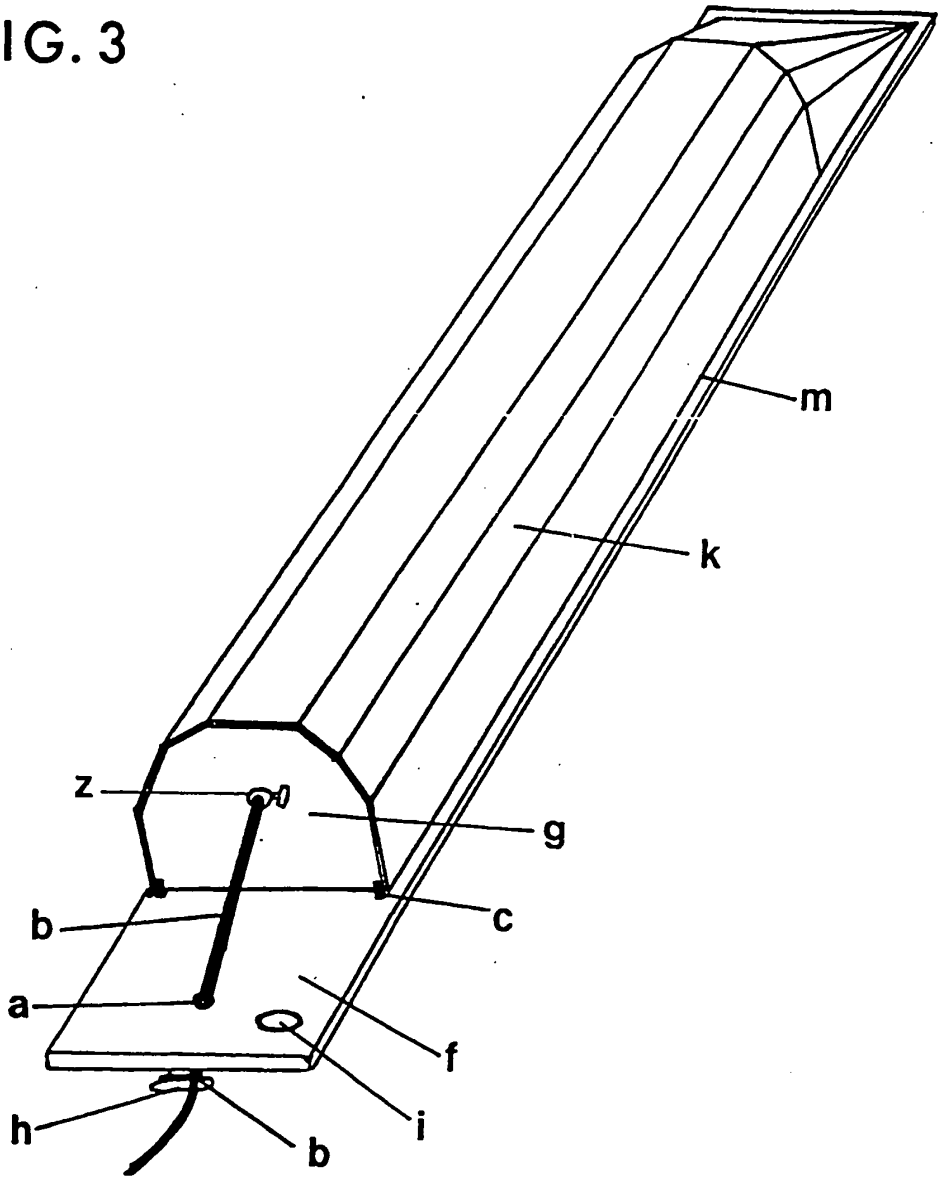


FIG. 4

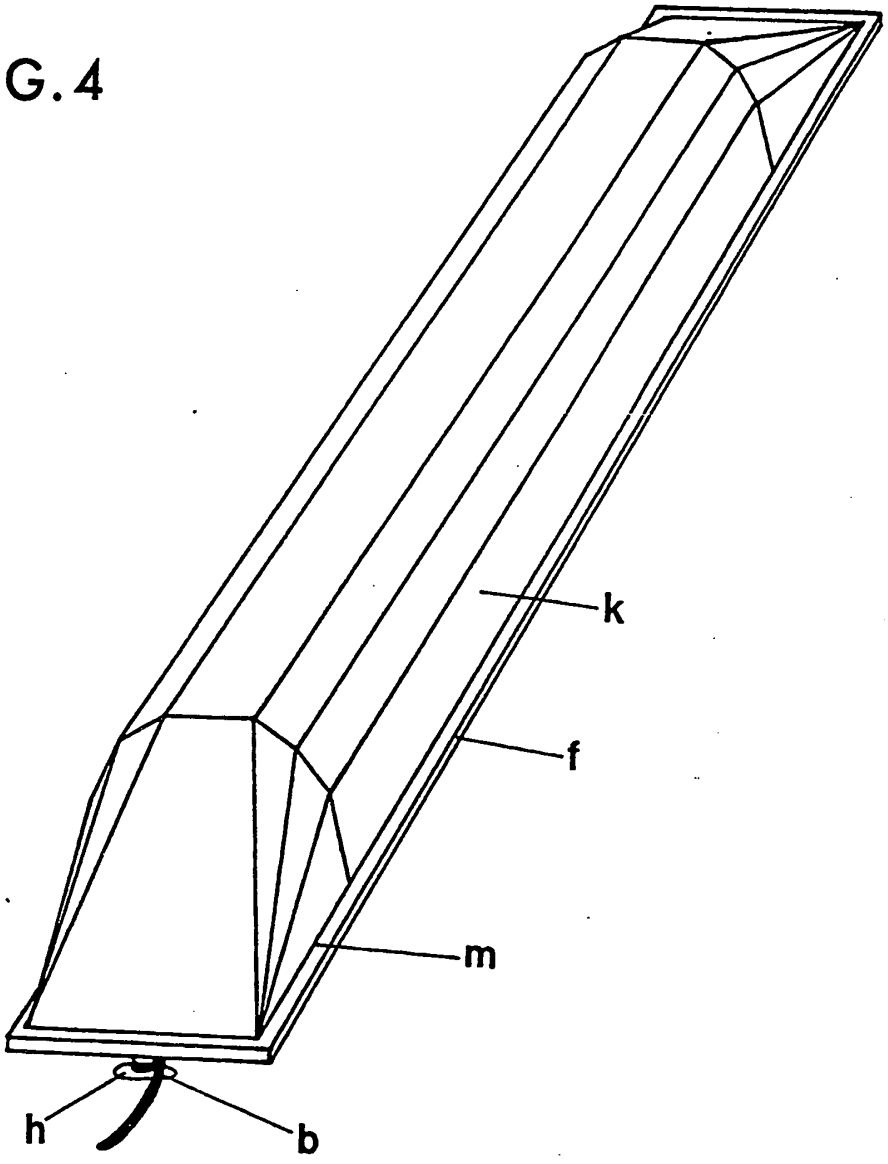


FIG. 5

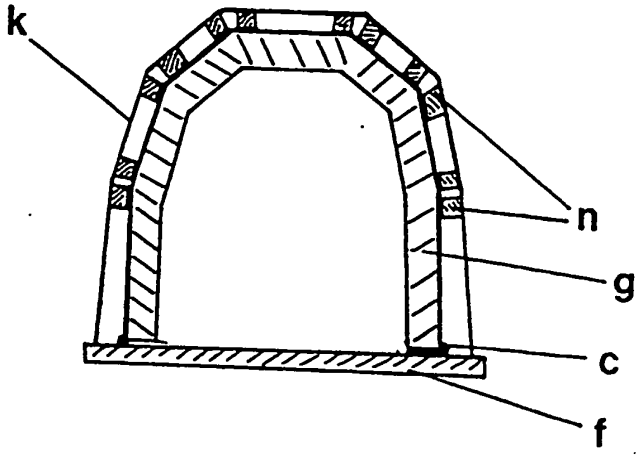


FIG. 6

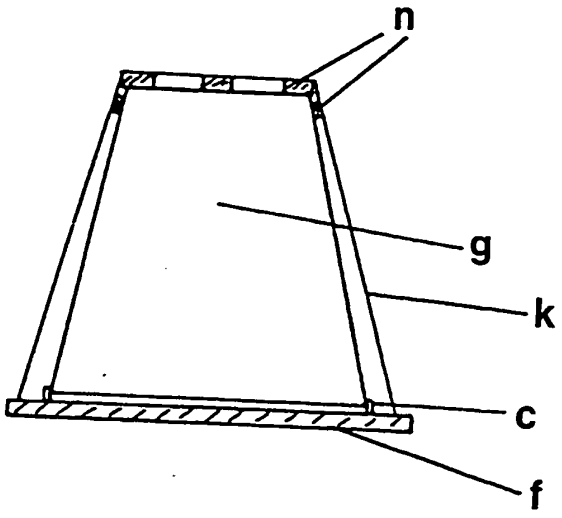


FIG.7

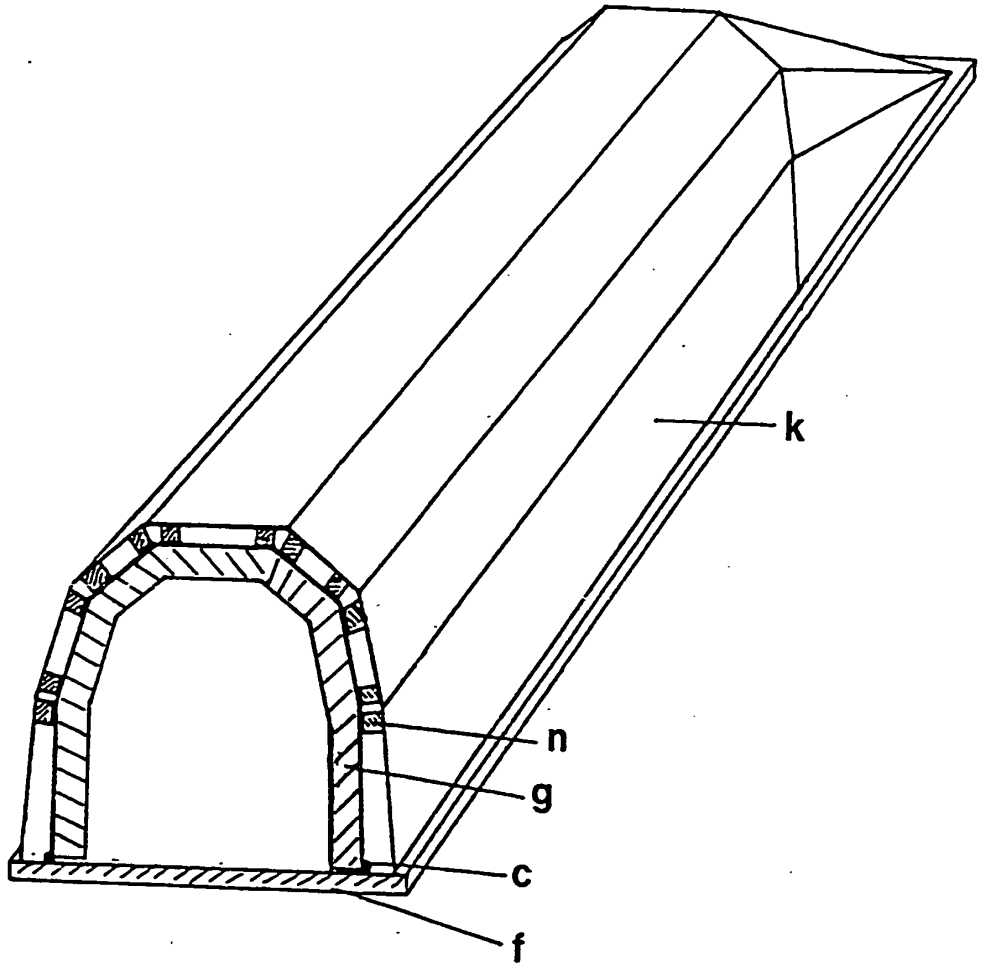


FIG.8

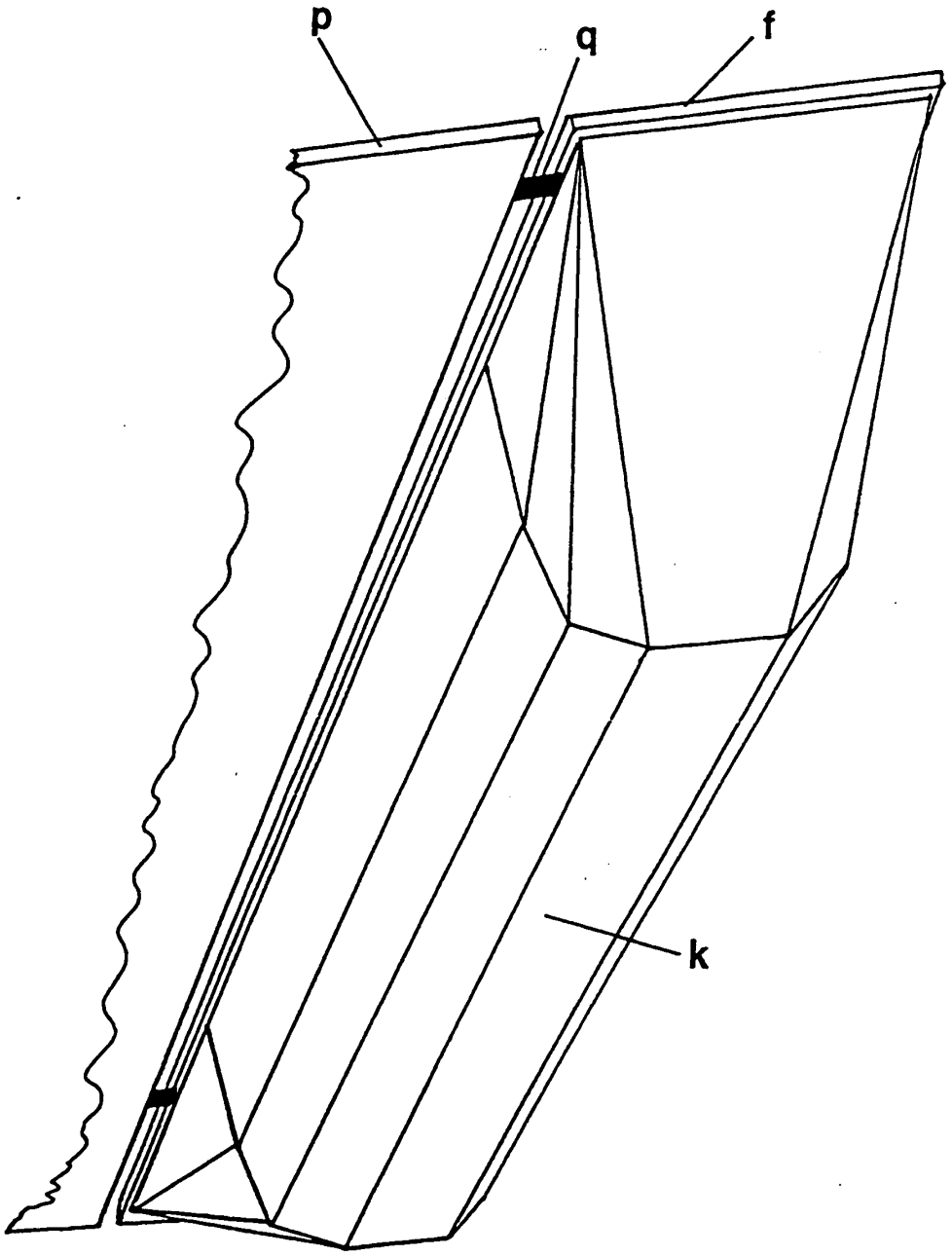


FIG.9

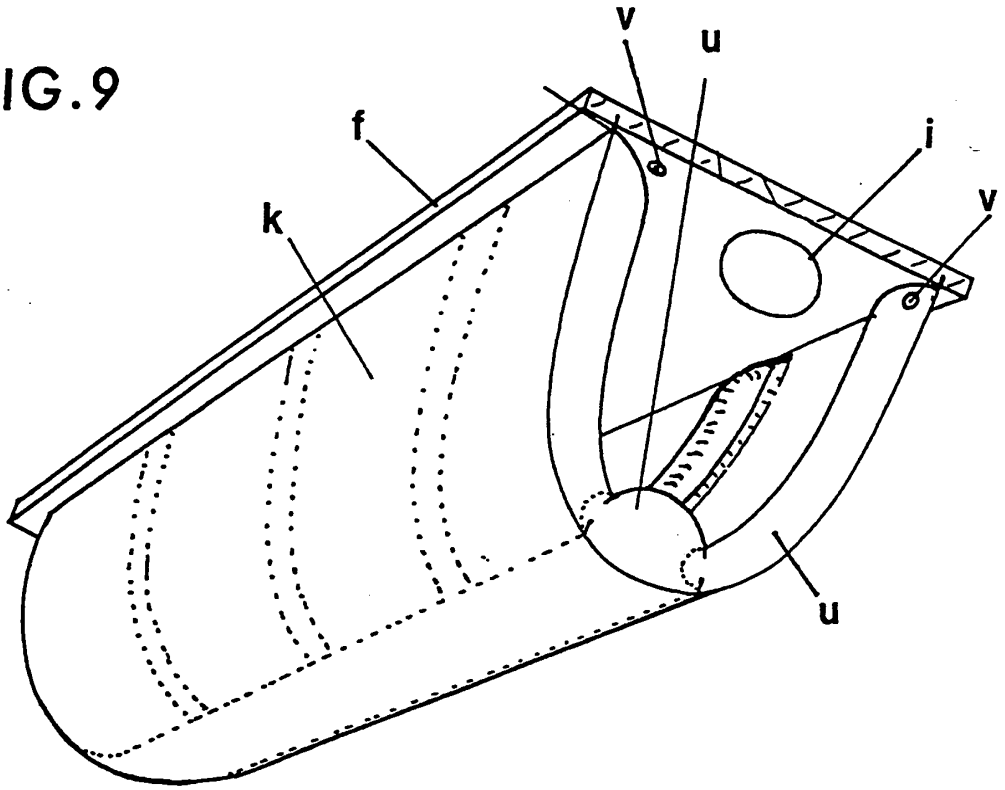


FIG. 10

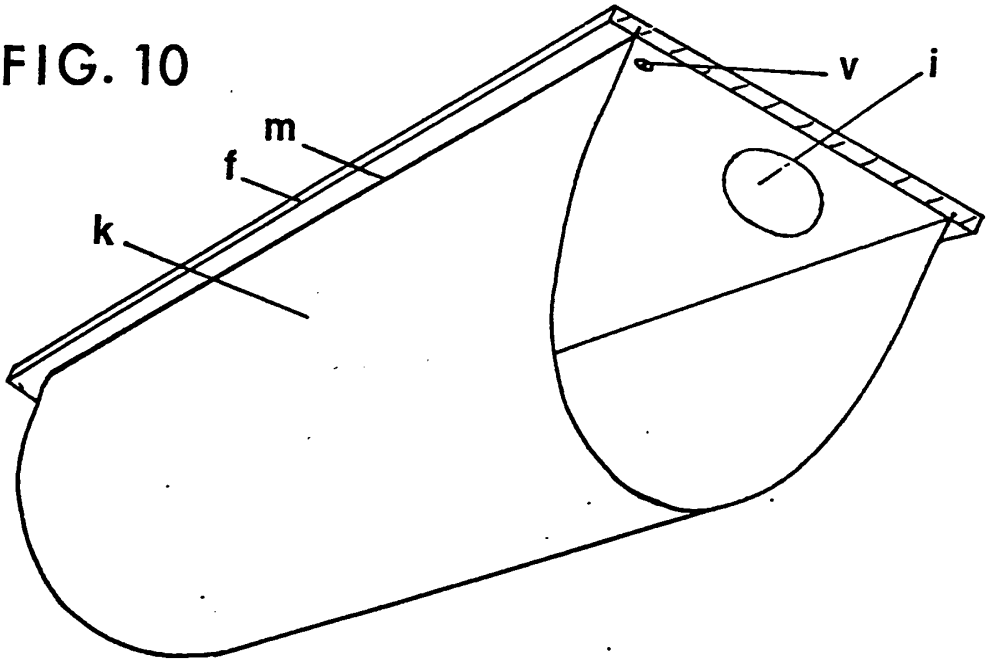


FIG. 11

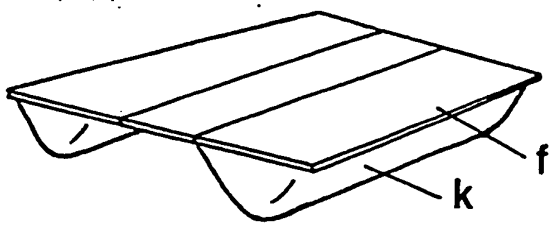


FIG. 12

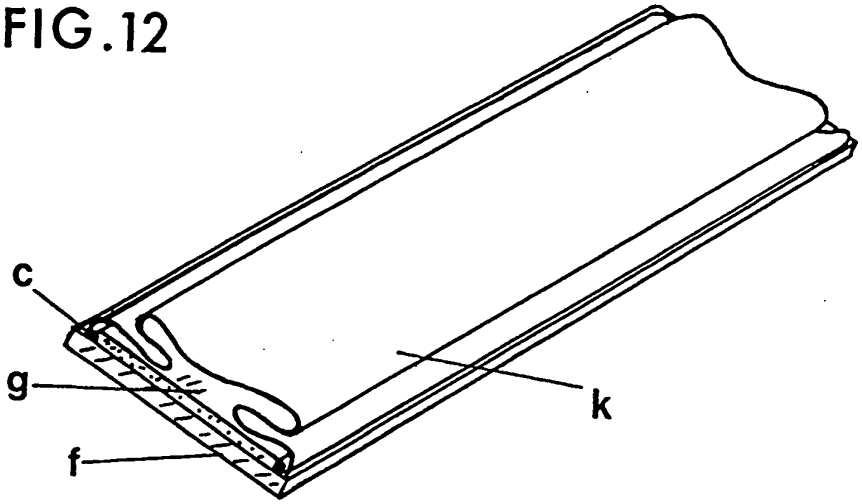


FIG. 13

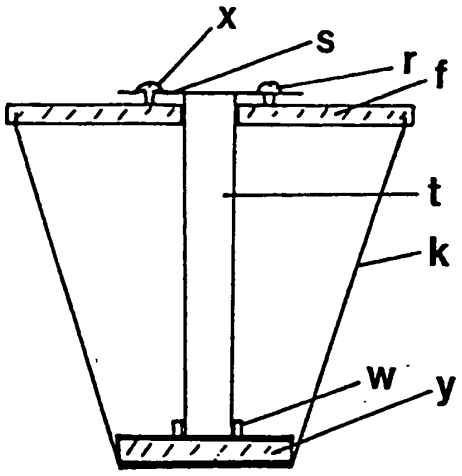


FIG. 14

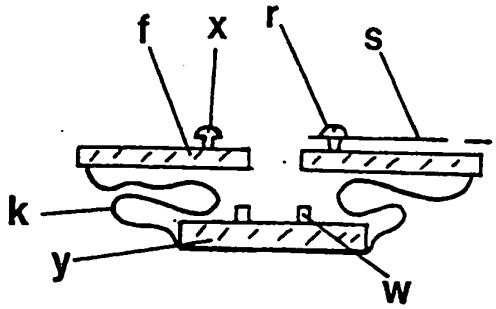


FIG. 15

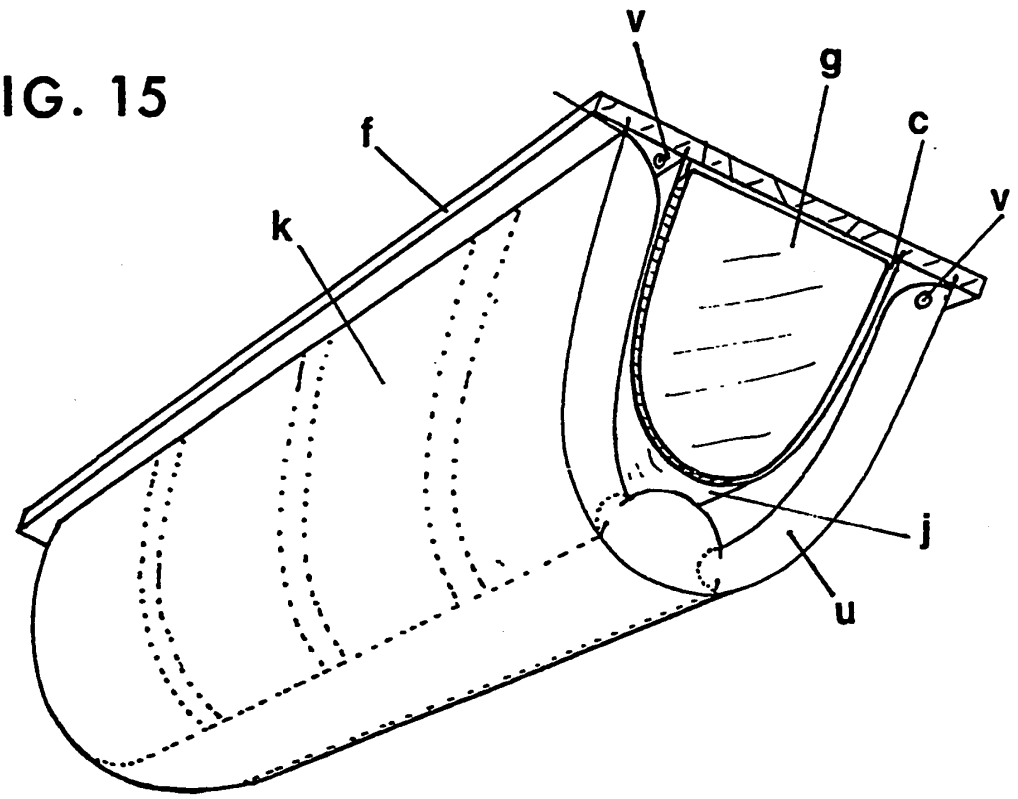


FIG. 16

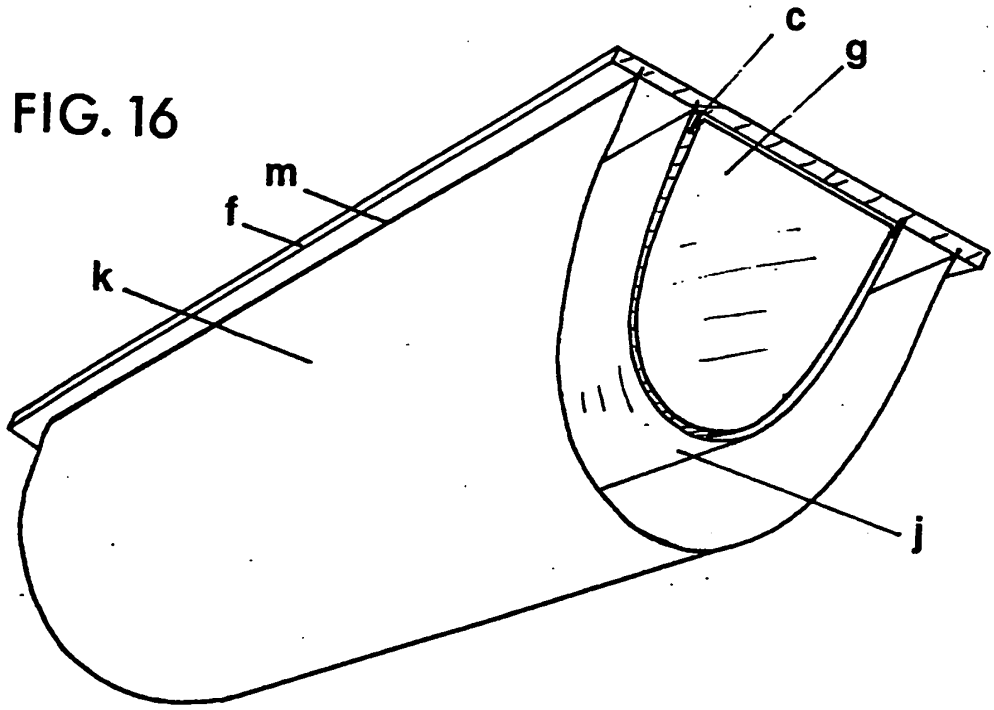
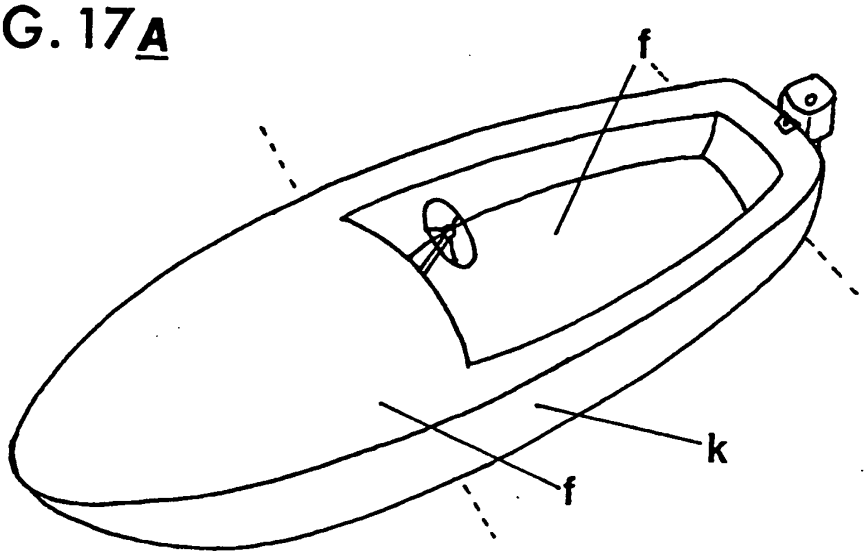
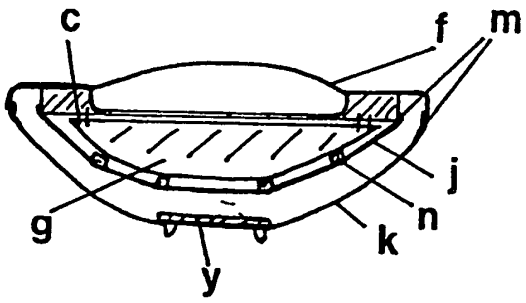


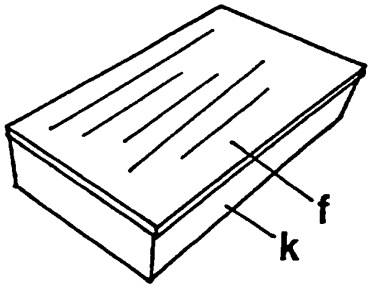
FIG. 17A

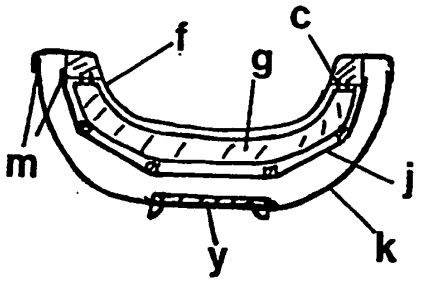


B

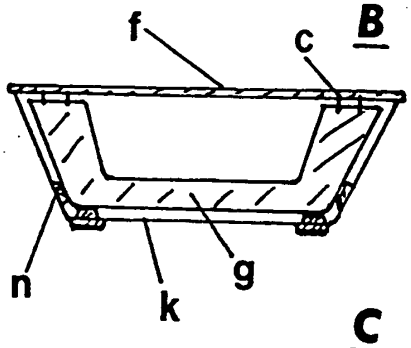
FIG. 18 A







C



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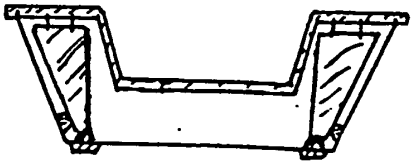
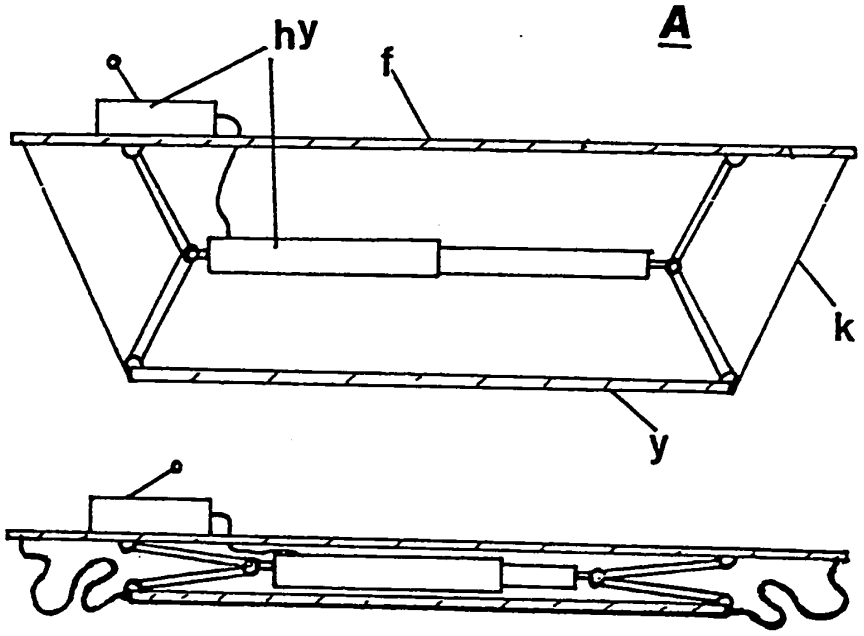


FIG . 19



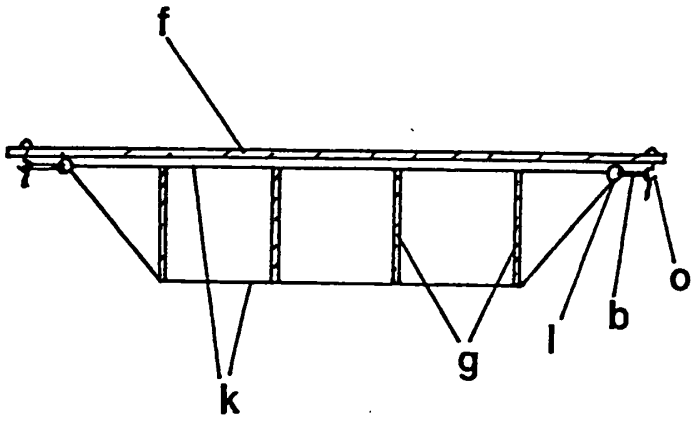


FIG. 20 A

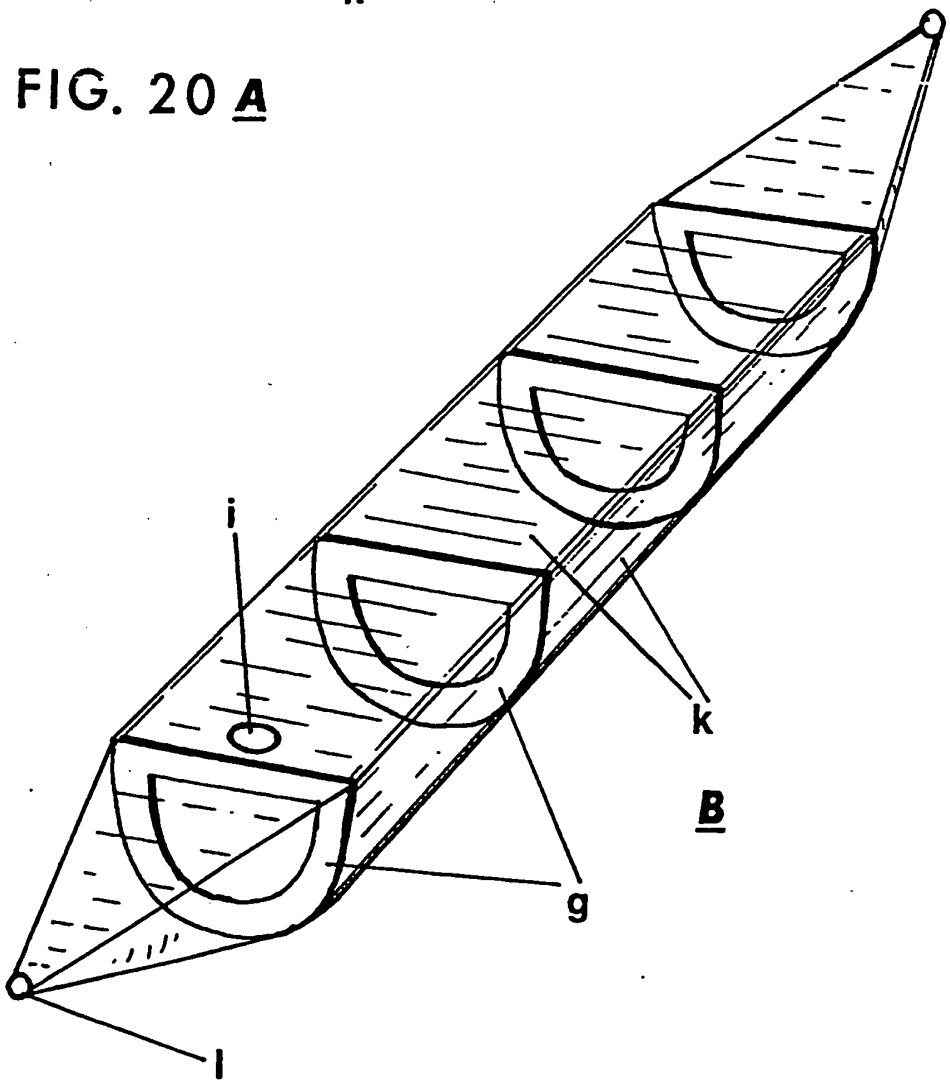
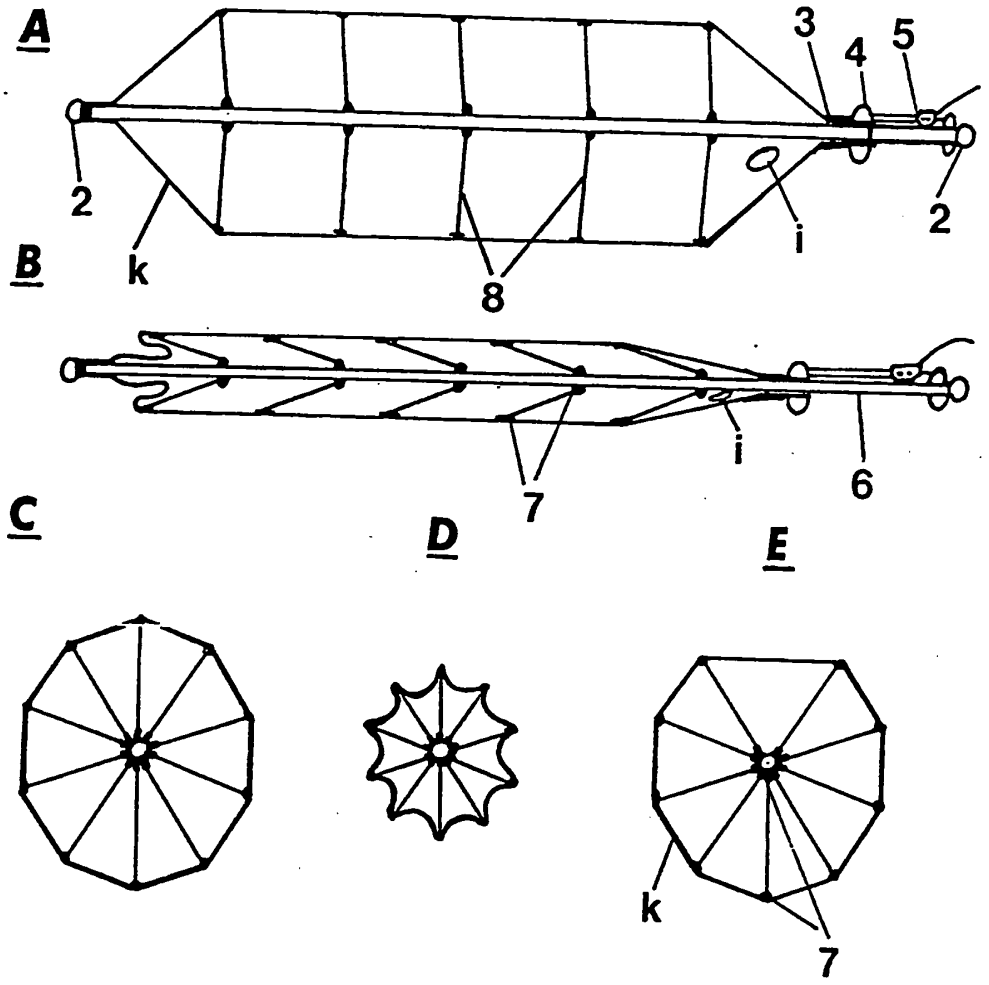


FIG. 21



IMPROVEMENTS IN AND RELATING TO FLOATING STRUCTURES

The present invention relates to improvements in and related to collapsible hulls.

Floating structures such as rafts, catamarans, pontoons and the like depend for their bouyancy on the incorporation of one or more floats, or to use another word which in the present context is understood to have the same meaning, hulls, which are closed structures, as opposed to the open structure of a rowing - boat for example, filled with air at atmospheric pressure or more than atmospheric pressure. The advantage of using hulls made out of rigid materials such as glass reinforced plastic is that it is not necessary to inflate them before use, the disadvantage being that they cannot be collapsed to facilitate transport and storage as with the case of pneumatic dinghies the which in turn have the disadvantage of having to be inflated before use, in the case of them having been collapsed , this operation , in the case of a medium to large pneumatic dinghy necessitating the use of a compressor or a long period of hand or foot pumping.

According to the present invention there is provided a collapsible, flexible, air - filled hull suitable for use on its own, and this according to the stability of the design, or for incorporating into different types of floating structures such as rafts, catamarans, pontoons and the like, the particularity of this hull being that it may be expanded from a collapsed state or collapsed from an expanded state by means of a mechanism which includes at least one collapsible and / or removable support and which is situated at the interior and operated from the exterior of the said hull.

The design and fabrication of the aforementioned mechanism may be in accordance with any suitable, known means or as hereafter particularly described. It will be seen that the innovatory element common to all the examples used to illustrate the different forms that the invention may take and described in the following text , is the process of sucking air into the flexible hulls during the expanding operation, as opposed to injecting air into the hull as in the case of the inflation of a pneumatic dinghy of the type " Zodiac ", for example, and this due to the action upon

the hull of the said mechanism situated inside the said hull, air being sucked into the expanding hull through at least one hermetically closable vent incorporated into the hull or the top of the said hull.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which : -

Figure 1A shows in perspective the underside of a rigid top to which the said flexible hull has not yet been attached, the said top being made of plywood or any suitable material, and to which are attached hinged supports the function of which is to expand the said hull by moving into a vertical position, the position of the top being taken now and during the description as horizontal, this operation being effected by means of cords as shown, or by any suitable, known means, the supports being repositioned horizontally to allow the collapse of the hull when it is not in use.

Figure 2 illustrates the underside of the rigid top of a hull with the said hinged supports in their vertical position.

Figure 3 shows a cut away view of a collapsible hull attached to its rigid top, the hull being supported by hinged supports in their vertical position.

Figure 4 shows a perspective view of one of the many possible forms of hull that may be made according to the invention, the cut away view being shown in Figure 3.

Figure 5 shows a cross - section of a collapsible hull similar to that shown in Figure 5 and where the said hull is reinforced by longitudinally placed ribs made of wood or any suitable material, the said ribs being attached to the inside of the flexible skin of the hull thus protecting the skin against wear caused by the rubbing of the supports, which in this case are in the form of an arch.

Figure 6 shows a cross - section of a collapsible hull similar in structure to that shown in Figure 5 except that the form is different.

Figure 7 shows a cut away view of a collapsible hull the cross - section of which is illustrated by Figure 5 .

Figure 8 illustrates by way of example a collapsible hull incorporated into a floating structure such as a raft or a catamaran.

Figure 9 illustrates a collapsible hull wherein the support for the flexible skin of the hull is a system of inflatable tubes attached to the inside of the said skin. These tubes being of relatively small volume when inflated, are by consequence relatively easy to inflate even with a hand or foot pump.

Figure 10 shows the cut away view of a collapsible hull the flexible skin of which opens out due to the weight and elasticity of the skin itself, the collapsible support in this case being the structure of the skin itself acting under the influence of gravity.

Figure 11 shows a vessel incorporating two collapsible hulls and a deck.

Figure 12 shows a cut away view of a collapsible hull with top, in its collapsed state, the hinged supports being in their non - operational, horizontal position and folded flat against the underside of the said top.

Figure 13 shows a cross - section of a collapsible hull wherein the flexible skin, which in this case is reinforced by a wide longitudinally placed runner, is expanded and kept under tension by means of a tube or rod introduced into the hull through a hole in the rigid top and held in place by means of a movable plate.

Figure 14 shows a cross - section of the collapsible hull illustrated in Figure 13 without the said support in place, the said hull being in a collapsed state.

Figure 15 shows a cut away view of a collapsible hull similar to that illustrated by Figure 9 and wherein is incorporated an inner flexible skin inside of which is a mechanism for expanding and collapsing the said skin, the said mechanism being , as in accordance with the invention, operated from the exterior of the hull.In this example of the different forms that the present invention may take, vents must be provided to allow air to flow freely into or out of both the inner and outer compartments of the hull.

Figure 16 represents a collapsible hull with rigid top, similar to that shown in Figure 15 but in this case the outer skin is not supported by a system of inflatable tubes, the flexible outer skin dropping into place as described for the bouyant element shown in Figure 10. Once the outer skin has dropped into place its respective vent is then closed the inner skin then being expanded and so compressing the air trapped between the two skins, as for the example shown in Figure 15. Air valves may of course be incorporated in the case where it is desirable to have the possibility of adding a complement of air by means of a pump, for example.

Figure 17A, 17B and 17C illustrate a motor - boat the top of which is made of glass reinforced plastic and wherein the collapsible hull is composed of an inner and outer skin as described for Figure 16.

Figures 18A and 18B illustrate a raft the hull of which is collapsible and the structure of which is similar to that illustrated by the examples shown in Figures 5 and 6.

Figure 18C represents a vessel similar to that shown in Figures 18A and 18B but in which the top and the movable supports have a different form.

Figures 19A and 19B illustrate a collapsible hull plus top, the form and structure of which is similar to that shown in Figure 13 but wherein the system of collapsible supports is a hydraulic system.

Figures 20A and 20B represent a collapsible hull which is detachable from its rigid top or deck as it may be called. As shown in the diagram the detachable hull is in the form of a flexible tube, the supports of the hull being attached to the inside of the said hull in such a way that when the said hull is stretched and atached in a stretched state to the underside of its rigid deck, the vent having been opened to allow air to flow freely into the hull, the said hull expands to its operational form and volume, in much the same way that a fisherman's keep - net expands when it is prepared for use, a difference being that in the case of the said hull,air is sucked in during the said expanding action.

The collapsible hulls represented by Figures 21A, B, C, D and E are in the form of tubes made of a material such as a tissue impregnated with " Hypalon " , and inside of which there is a system of collapsible supports the mechanism of

which is similar to that used for opening and closing an umbrella. Figure 21A shows a longitudinal view of a cross - section of a collapsible hull in its fully expanded state ready to be incorporated into a floating structure. Figure 21B shows the same hull in its collapsed state. Figure 21C shows the same hull as illustrated by Figures 21A and 21B but in this case it is the cross section as seen across its width that is seen, the tube being fully expanded. Figure 21D represents the same cross - section but in this case the hull is only partly expanded. Figure 21E shows the cross - section of a similar structure the form of which is slightly different.

Referring to the drawings, Figures 1, 2, 3 and 4 together represent a collapsible hull with a rigid top, in which the collapsible supports g are attached by hinges c to the top f, the said supports g being moved from the horizontal position to the vertical position by pulling on the cord b which passes through the holes a in the top f of the said hull, the cord b , once sufficiently tight, being fastened to a cleat h.

The cord b is attached at its middle point to the top f by means of a clamp e. Stops z are attached to the cord b as shown in Figure 2 so that when the ends of the cord b are pulled tight , the hinged supports g are held firmly in a vertical position. An elastic cord or a spring d is attached to the two middle supports as shown in Figure 2 in such a way that when the ends of the cord b are released the hinged supports revert to their horizontal position. A vent i is incorporated into the top f to allow air to flow freely into or out of the hull during the operations of expanding and collapsing the said hull, the said vent being hermetically closed during navigation.

Figures 5 and 6 show cross - sections of collapsible hulls wherein the flexible skins K are reinforced by longitudinally positioned ribs n which are attached to the insides of the skins k and against which the hinged supports g press when they are in the vertical position, the said ribs n preventing the wearing of the insides of the skins k due to the rubbing of the supports.

Figure 7 shows the cut away view of a collapsible hull with rigid top, the skin k of which is reinforced by the ribs n. The hinged support g is attached to the top f by means of the hinges c.

Figure 8 shows a collapsible hull with rigid top, attached to a deck p by a joint q , this figure representing in a general way how the said collapsible hulls may be incorporated into different types of floating structures.

Figure 9 shows a cut away view of a collapsible hull with rigid top, the said hull being supported in its operational state by a system of inflatable tubes u which are attached to the inside of the skin k. When the tubes are inflated , by means of a pump for example, the flexible hull expands at the same time , air being sucked into the hull through the open vent i in the top f . This system work in much the same way as the well known system used for the erection of certain tents which are equipped with inflatable supports. In order to facilitate the use of this system, the assembly of hull and top may be raised off the ground by the use of , for example, folding props attached to the edge of the top f. For additional security the system of inflatable tubes may consist of more than one section. As in the case of the other collapsible hulls already mentioned a compliment of air may be introduced to improve the efficiency of the hull the necessary air valves being incorporated for this purpose and the complete assembly of hull,top and mechanism being rendered airtight accordingly.

Figure 10 shows the cut away section of a collapsible hull with rigid top , the flexible hull opening out under its own weight and due to its elasticity, the vent i being open during this operation to allow air to be sucked freely into the hull . Once the hull reaches its expanded state the vent is closed and a complement of air injected into the hull through a valve v. The joint m between the flexible skin k and the top f must obviously be airtight and waterproof.

Figure 11 represents a vessel wherein two collapsible hulls having rigid decks or tops, are attached one either side of a central deck.

Figure 12 shows a cut away view of a collapsible hull with rigid top, the hinged support g being folded flat against the underside of the top f allowing the flexible skin k to be folded. It is evident that the assembly, collapsible hull with its top, is easier to transport and store in its collapsed state.

Figures 13 and 14 represent a collapsible hull with rigid top, in an expanded and collapsed state respectively, wherein the flexible skin k is held under tension by means of a tube t which passes through a hole in the top f , the said

tube plugging into a socket w which is fixed to a reinforcement y made of plywood for example, the tube being blocked in position by means of a movable plate s. As for all the examples described and according to the invention, provision must be made to allow air to be sucked freely into the opening hull. Referring to Figure 14 it is easy to imagine the tube t shown in Figure 13 being inserted into the hull through the hole in the top f and then being pushed against the reinforcement y thus stretching the skin k to its full operational volume, the air being sucked into a vent of adequate size situated for example in the top f, this vent being closed once the hull is completely expanded and the tube t blocked firmly in place. The means of forcing the tube into position so as to put the skin k under sufficient tension may be in the form of a lever or any suitable known means that a competent engineer is capable of designing.

Figure 15 shows a cut away view of a collapsible hull with rigid top, similar to that illustrated in Figure 9 and wherein is incorporated an inner skin j inside of which is situated a system of movable supports g, these being attached by hinges to the underside of the top f.

According to the invention and referring to Figure 15 to prepare the collapsible hull for use , it is raised sufficiently high above the ground to allow the full expansion of the said hull to take place, and this by the inflating of the system of flexible tubes u.Once the outer skin k is expanded and the vent controlling the flow of air into and out of the space between the two skins, is closed, the hinged supports g situated inside the inner skin j are brought into their vertical position thus expanding the inner skin j and so compressing the air trapped between the two skins.Air valves v are incorporated into the said system of tubes u for inflating the said system, and air valves v are incorporated into the top f or the skin k for the purpose of increasing the air pressure in the space between the two hulls should this be necessary.

Figure 16 illustrates the cut away section of a collapsible hull with rigid top, similar to that shown in Figure 15 but without a system of inflatable tubes, where k is the outer skin, j is the inner skin, f is the top, made of plywood for example, where m is the airtight waterproof joint between the flexible skin and the top, g is a hinged support attached by hinges c to the top f.

According to the invention and referring to Figure 16 , the collapsible hull is got ready for use on the water from its collapsed state , in the following way. The vents controlling the flow of air into the space beween the outer skin k and the inner skin j, and the space between the inside of the inner skin j and the top f , are opened. The hull is raised high enough above the ground , by means of props or other suitable means, so that the outer skin k can expand freely. Once the outer skin k has dropped into place the vent controlling the flow of air into the space between the two skins , is closed. The hinged supports g are then brought into their vertical position thus causing the inner skin j to expand thus at the same time compressing the air trapped between the two skins. The vent controlling the flow of air into the space between the inside of the inner skin j and the top f is then closed. The hull is now ready for use, a complement of air being injected into the space between the two skins if this is considered necessary.

It is evident that in the case of collapsible hulls constructed according to the principals of the invention and in which a volume of air is compressed by the expanding of an inner skin as in the case of the hull illustrated by Figure 15 , the proportions concerning the volume of trapped air to the overall volume of the hull must be carefully considered, so that the pressure of the compressed air is correct.

Figures 17A, 17B and 17C illustrate a motor - boat where f is the top made of glass reinforced plastic, k is the outer skin of the hull, where m is the waterproof and airtight joint between the flexible outer skin k and the top f, and where m is the airtight and waterproof joint between the inner skin j and the top f, where g is a movable support attached to the top f by hinges c, where n represents the longitudinally positioned ribs attached to the inside of the skin j and where y is a longitudinal reinforcement attached to the bottom of the inside of the outer skin K. The motor - boat illustrated by Figures 17A, B and C is similar in construction to the collapsible hull illustrated by figure 16 except that the inner skin of the motor - boat is reinforced by longitudinal ribs against which the hinged supports press when they are in their vertical position, the sequence of operations necessary to the preparation of the boat from its collapsed state to its state of readiness for navigation being the same.It is evident that the necessary vents will be incorporated into the structure of the boat.

Figure 18A illustrates a simple raft the cross - section of which is illustrated by Figure 18B and where f is the top, made of plywood for example, where g represents a hinged support, where c represents a hinge with which the support g is attached to the top f, where k represents the flexible, waterproof, airtight skin of the hull, and where n represents a longitudinally positioned rib attached to the inside of the skin k.

Figure 18C represents a similar vessel to that illustrated by Figures 18A and 18B except that the form of the top f is different as is the shape of the hinged supports.

According to the invention the collapsible hull is expanded and given its form by means of its interior system of collapsible and / or removable supports. As for all cases of collapsible hulls described herein together with any collapsible hulls made according to the principals of the present invention, vents must be incorporated into the structure of the said collapsible hulls in such a way that air may freely flow into or out of the the said hulls, the said vents being hermetically closable and positioned according to the needs of the different operations relative to the working of the present invention.

Figures 19A and 19B illustrate a collapsible hull similar to that illustrated by Figure 13 but where the system for expanding the flexible hull k is a hydraulic system by.

Figures 20A and 20B represent a collapsible hull , the flexible skin k of which is in the form of a flexible tube, it being attached to its rigid top f by means of rings l fixed to the ends of the flexible skin k, by cords b and hooks o. When the flexible skin k is stretched tightly between the two hooks o and attached to the said hooks by means of the cords b, the rigid supports g which are attached to the inside of the skin k give the said hull its operational form, air being sucked into the skin k through the vent i.For transport and storage purposes the collapsible hull can be detached from its rigid top f and folded in much the same way that a fisherman's keep - net is folded after use. The collapsible hull illustrated by Figures 20A and 20B illustrate clearly, as do the other examples herein described , the basic principal of the present invention, that is to say , the expanding of a collapsible hull from its collapsed state to its expanded, operational state and this by means of a system of collapsible and / or removable supports situated inside the said flexible hull, the said system of supports being manipulated from the exterior of the said hull thus causing the hull to expand to its operational form and volume and so sucking in

the air necessary for bouyancy and this as opposed to the injection of air as in the case of the inflation of a pneumatic dinghy of the type " Zodiac " for example.

Figures 21A, B, C, D and E represent collapsible hulls in the form of tubes , the system of collapsible supports situated at the interior of the said tubes, being similar to the mechanism employed for opening and closing a typical umbrella, the rods 8 being attached to the inside of the skin k and the central tube 6 by means of hinges 7. When the metal or plastic sleeve 3 which is attached to the end of the flexible skin k is pulled towards the end of the tube 6 by means of the cord and pulley system 5, the supports 8 change position causing the flexible skin k to expand, air being sucked into the expanding hull through the open vent i. The half ring 4 is used for attaching the cord and pulley system 5 to the sleeve 3 , and the rings 2 are used for attaching the hull in its expanded state , when incorporating the said hull into a floating structure.

Figure 1B illustrates by way of example a system for rendering airtight and waterproof the point on the deck where the cord used for manipulating the hinged supports , as illustrated in Figures 1 and 2 for example, leaves the said deck through a hole a, where 7 is a spring - clamp, where 6 is a hole in the deck through which the end of the cord b enters the hull ,the end of the cord simply hanging down into the hull while it is in its expanded state, the end of the cord being pulled out of the hole 6 and released from the spring - clamp 7 when the hull is to be collapsed.During navigation the cap 2 with its rubber seal 3 is tightly closed thus rendering the assembly waterproof and airtight, the cap 2 being held in a closed position by means of a catch 4, the said cap being attached by means of a hinge 5.

CLAIMS

1 A collapsible, flexible, air - filled hull possessing a rigid or a flexible top, the said hull being expanded from its collapsed state or collapsed from its expanded state, by means of a mechanism including at least one collapsible and / or removable support situated at the interior and operated from the exterior of the said hull, air being sucked into or expelled from the said hull during the operations of expanding and collapsing, through at least one hermetically closable vent incorporated into the said hull or top of the said hull, the said collapsible, flexible, air - filled hull being suitable for use on its own or for incorporating into different types of floating structures such as rafts, catamarans, pontoons and the like, and this according to the individual form given to the present invention.

2 A hull as claimed in Claim 1 wherein the top is rigid and made of plywood, aluminium, plastic or reinforced plastic.

3 A hull as claimed in Claim 2 wherein the said support or supports is / are made of plywood, aluminium, plastic or reinforced plastic, and attached by hinges to the underside of the top of the said hull.

4 A hull as claimed in Claim 3 wherein the mechanism situated at the interior of the said hull is operated from the exterior of the said hull by means of a cord or cords attached to the said support or supports, the said cord or cords passing through one or more than one suitably positioned hole in the said hull or top of the said hull.

5 A hull as claimed in Claim 4 wherein the said mechanism includes more than one hinged support and wherein an elastic cord or a spring is attached to the said hinged supports in such a way that when the cord or cords holding the supports in a vertical, that is to say operational position, is /are released , the hinged supports revert to their horizontal, that is to say, collapsed position.

6 A hull as claimed in Claim 1 or Claim 2 wherein the said hull is expanded or collapsed by means of at least one inflatable tube attached to the inside of the flexible skin of the said hull.

7 A hull as claimed in Claim 1 or Claim 2 wherein the collapsible support is provided by the elasticity of the material out of which the skin of the said flexible hull is made.

8 A hull as claimed in Claim 1 or Claim 2 wherein at least one removable support in the form of a tube or a rod is introduced into the said hull through a hole made in the top of the hull the said tube or rod being forced against the reinforced bottom of the said hull thus expanding it to its operational form and volume, the said tube or rod being held in place during navigation by means of a suitable catch.

9 A hull as claimed in Claim 6 wherein is incorporated a flexible inner hull at the interior of which is situated a mechanism including at least one collapsible and / or removable support, the said inner hull when expanded by the said mechanism , compressing the air trapped between the inner and outer hulls.

10 A hull as claimed in Claim 7 wherein is incorporated a flexible inner hull at the interior of which is situated a mechanism including at least one collapsible and / or removable support , the said inner hull when expanded by the said mechanism, compressing the air trapped between the inner and outer hulls.

11 A hull as claimed in Claims 1 to 10 wherein the top of the said hull is made of plastic, or reinforced plastic and in the form of the top of a motor - boat.

12 A hull as claimed in Claims 1, 2, 3, 4, 5, 8, 9, 10 and 11 wherein the inside of the hull in which is situated the said mechanism, is protected from wear, caused by the rubbing action of parts of the said mechanism, by the attachment of appropriately placed ribs to the inside of the flexible skin of the said hull.

13 A hull as claimed in Claim 1 wherein the said top is flexible , the hull and the top together forming a tube in which are situated a number of collapsible supports which are not attached to one another except by their attachment to the inside of the skin of the tube, the said tube expanding to its operational form and volume when stretched and attached in a stretched state to the underside of a rigid deck, the said tube expanding in much the same way that a fisherman's keep - net expands when prepared for use.

14 A hull as claimed in Claim 1 wherein the mechanism employed for expanding and collapsing the hull is similar to that used for opening and closing an umbrella.

15 A hull as claimed in Claims 1 to 14 wherein the skin of the said hull is made of a tissue impregnated with an elastomer such as that sold under the name of " Hypalon " or a material possessing similar qualities.

16 A hull as hereinbefore described with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition K) B7A (ADS AGT)

(ii) Int Cl (Edition 5) B63B

Search Examiner: B J PRICE

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search: 24.6.91

Documents considered relevant following a search in respect of claims: 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 1003357 A (WESTLAND) whole document	1,4

SF2(p)

Category	Identity of document and relevant passages	Relevant to claim(s)

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